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Fire Management Notes

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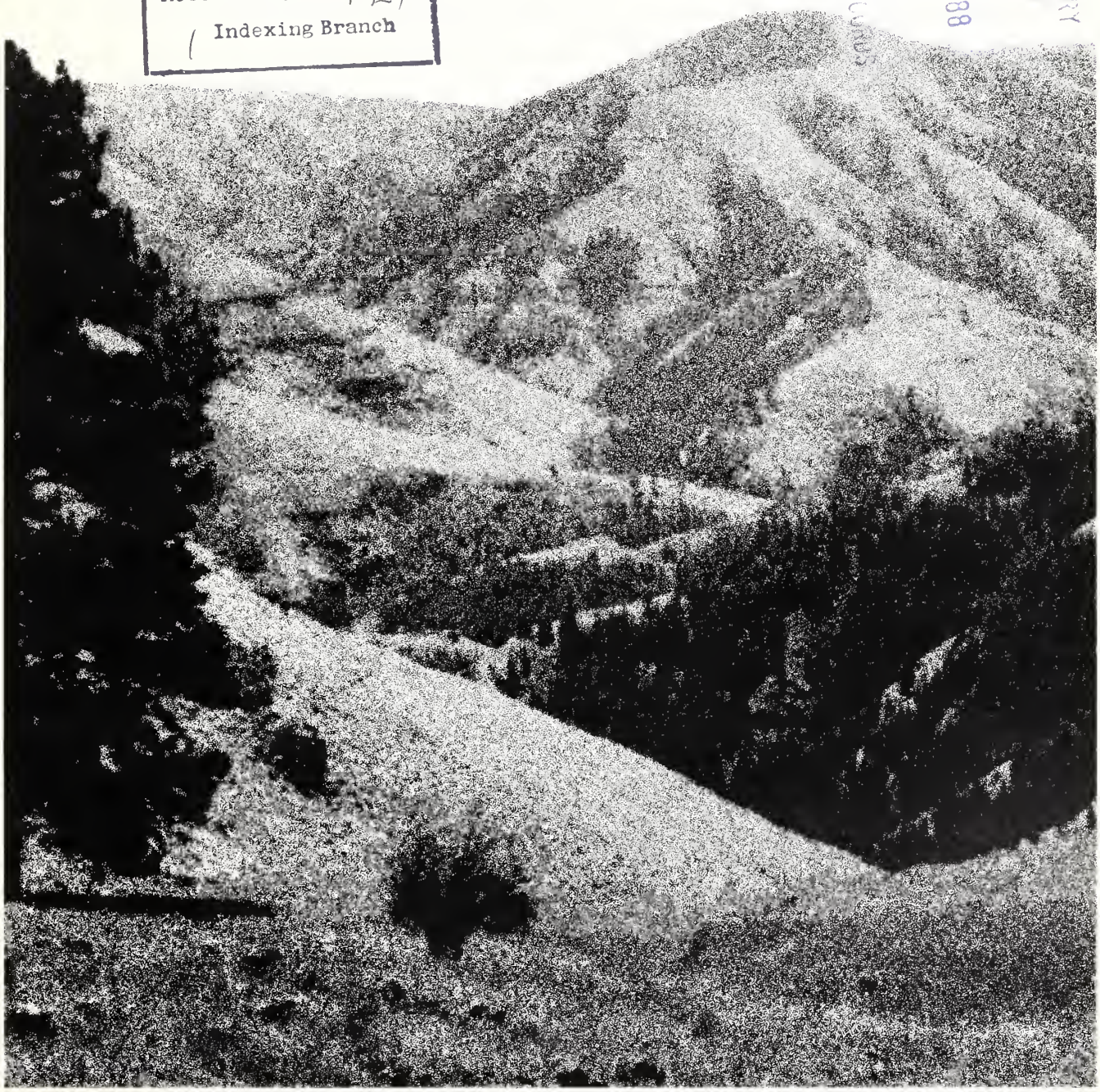

Fire Management Notes

An international quarterly periodical devoted to forest fire management

United States
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Agriculture

**Forest
Service**

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Contents

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Cover: View from Baker Butte up Joseph and Swamp Creek Canyons. Site of the Joseph Canyon Fire, August, 1986. See story beginning on p. 17.

Firefighter Safety: A New National Emphasis

Gene A. Morse and Jerry L. Monesmith

Respectively, training and safety officer, Florida Division of Forestry, Tallahassee, FL; and safety and training officer, Fire and Aviation Management, USDA Forest Service, Washington, DC

"Firefighter Safety" — It's like motherhood and apple pie: Everybody is for it—nobody is against it—but what is being done about it?

Concerted interagency efforts to do something on a national scale to further the worthy cause of firefighter safety have not been particularly evident over the past few years. Fatalities have occured, commanded national attention for a short time, and then drifted into the background.

Two recent events, however, provide strong encouragement for the advocates of more interagency emphasis on firefighter safety:

- The recent completion, by a small interagency working group, of a new firefighter safety course specifically designed to develop an awareness of "Watch Out!" situations and Standard Fire Fighting Orders. This awareness is heightened by a structured process trainees follow as they work their way through the video interactive course.
- The approval given last year, by the National Wildfire Coordinating Group, to establish the Fireline Safety Committee. Although the proposal had been considered on other occasions, it was the leadership of John M. Bethea, Director of the Florida Division of Forestry, that finally prevailed late last year with the formation of this committee.

Not since the well-known and highly acclaimed Carl Wilson study, "Some Common Denominators of Fire Behavior on Tragedy and Near-Miss Forest Fires," and the NWCG "Task Force Report on Fatal/Near Fatal Fire Accidents" has so much attention been given to the issue.

"Carl Wilson's study covered the period 1926-76 and the task force report was completed in 1979," Bethea said. "Since 1926, forest and wildland fire suppression agencies have suffered more than 250 fire tragedies. It was certainly high time for a greatly accelerated national emphasis on fireline safety."

Standards for Survival

An interagency training group led by Bill Moody of the USDA Forest Service North Cascades Smokejumper Base, Winthrop, WA, has been working on the video interactive firefighter safety course titled, "Standards for Survival." Other members of the course development group include Jim Grant, USDA Forest Service Northern Training Center, Missoula, MT; Marv Wolfe, Boise National Forest, Boise, ID; Nic Anthony, Redmond Air Center, Redmond, OR; Frank Carroll, Coconino National Forest, Flagstaff, AZ; and Gene Morse, Florida Division of Forestry, Tallahassee, FL. The project has received the strong backing of the USDA Forest Service's Washington Office with overall direction and coordination provided by Jerry Monesmith, Fire and Aviation Management.

"The principal focus of this firefighter safety course is on the proper recognition of the "Watch Out!" situations followed by the initiation of appropriate actions as defined in the Standard Fire Orders," said L.A. Amicarella, Director of Fire and Aviation Management, USDA Forest Service, Washington Office.

"Watch Out!" Situations — Five items have been added to the "Watch Out!" situations list to reflect critical hazardous conditions that are not readily recognized. The list, rearranged into the sequence that the hazardous situations are most likely to occur, shows these new items in boldface type.

1. **Fire not scouted and sized up.**
2. In country not seen in daylight.
3. **Safety zones and escape routes not identified.**
4. Unfamiliar with weather and local factors influencing fire behavior.
5. **Uninformed on strategy, tactics, and hazards.**
6. Instructions and assignments not clear.
7. No communication link with crew members/supervisors.
8. **Constructing line without a safe anchor point.**
9. Building fireline downhill with fire below.
10. **Attempting a frontal assault on the fire.**
11. Unburned fuel between you and the fire.
12. Cannot see main fire, not in contact with anyone who can.
13. On a hillside where rolling material can ignite fuel below.
14. Weather is getting hotter and drier.
15. Wind increases and/or changes direction.
16. Getting frequent spot fires across line.
17. Terrain and fuels make escape to safety zones difficult.
18. Taking a nap near the fireline.

Standard Fire Fighting Orders — As one cynic has commented, these orders are like the 10 Commandments: Individuals readily admit that they believe in their worth—but they have some problems when asked specifically to identify and follow them. The "Standards for

Survival" course adopts a fresh approach to the traditional 10 Standard Fire Orders to combat this situation.

The Standard Fire Fighting Orders are re-cast in an acrostic format to trigger recall. The acrostic is an arrangement of sentences, each keyed to and beginning with, the letters contained in "Fire Orders." This technique is highly effective in promoting retention of the information.

Sense of the fire orders has not been changed—but the sequence has been changed, to conform to the acrostic structure. For example, the familiar fire order No. 10, "Fight fire aggressively but provide for safety first," now becomes the first fire order in the new format. This order is properly the first since it provides the overall basic safety rule. The order not only applies to potential entrapment situations, but to safe driving, use of tools and equipment, aviation, and other activities as well.

The Standard Fire Fighting Orders are:

F —Fight fire aggressively but provide for safety first.
I —Initiate all action based on current and expected fire behavior.
R —Recognize current weather conditions and obtain forecasts.
E —Ensure instructions are given and understood.

O —Obtain current information on fire status.
R —Remain in communication with crew members, your supervisor, and adjoining forces.
D —Determine safety zones and escape routes.
E —Establish lookouts in potentially hazardous situations.
R —Retain control at all times.
S —Stay alert, keep calm, think clearly, act decisively.

The Video Interactive Course — Resistance to change from a familiar procedure can usually be expected. However, the degree of acceptance for this new approach has been usually high. The video interactive course, which takes about 6 hours to complete, was first used for the Florida Division of Forestry's Basic Fire Control Training class for new forest rangers this past May. Once acquainted with the concept, and following some practical application through exercises, the 40 new firefighters were enthusiastic and committed to the new approach.

The course was also conducted in June at the Boise Interagency Fire Center for 24 firefighters with experience levels ranging from very little to 14 seasons of fire activity. Again, the course received a very positive overall response from the participants.

"Standards for Survival" employs a 1-hour video tape, supplemented with student workbook and exercises. The tape provides a detailed explanation of the "Watch Out!" situations along with instruction in the new fire orders. The information is presented in a manner that keeps the participants glued to the TV—fatality events are linked to violations of fire orders to drive home their importance.

Eight "scenarios" (re-enactments of dangerous fireline situations that led to fatalities) are utilized to pinpoint critical fireline events. Students are asked to identify hazardous situations noted in the scenarios, key them to the 18 "Watch Out!" situations, and then state the appropriate fire order(s) that must be observed. Instructor-facilitated discussion periods provide local knowledge and application for an effective instructional mix.

The course is primarily intended for beginning firefighters, but it would serve very well as a refresher course for experienced firefighters. Recommended course time frames are 6 to 8 hours for new firefighters and 3 to 4 hours for experienced individuals.

An effort was made to develop nationwide applicability for the course, with the video portraying hand crews at work in mountain and desert terrain along with tractor-plow firefighting activity in southern and eastern flatwoods.

The course was endorsed and certified for field use by the NWCG Training Working Team in July. Some minor changes are now being made, and the course should be ready for national use by early fall of this year. It will be available through the NWCG Publication Management System at the Boise Interagency Fire Cache.

John Chambers, USDA Forest Service Assistant Director for Operations, stated that "the effectiveness of the Standard Fire Fighting Orders and 'Watch Out!' situations depends upon the firefighter's

understanding of what each means and on recognition of their application in situations encountered. Time and time again, firefighters have come up short in this regard, at times with fatal consequences. Every crew supervisor is responsible for ensuring operational understanding and application of these critical guidelines to fighting fire safely."

NWCG Fireline Safety Committee

This committee was organized last fall and is now working on a number of projects designed to provide safer fireline conditions for the Nation's forest and wildland firefighters. The three-member committee was selected by NWCG, with representation from the USDA Forest Service, Department of the Interior, and State forestry agencies.

The committee chairman is Jerry L. Monesmith, USDA Forest Service, Washington Office. Other members are Stanton L. Palmer, Bureau of Land Management, Boise, and Gene A. Morse, Florida Division of Forestry. The primary mission of the Fireline Safety Committee is to serve NWCG as a national clearinghouse for major forest/wildland fire suppression accident data analysis and dissemination. This mission includes the development of a standardized, consistent approach to the collection, analysis, and distribution of information relating to fatalities, major fire-related injuries, and life-threatening near-miss accidents occurring in forest/wildland fire operations.

The primary objectives of the Committee are to:

- Provide recommendations for uniform reporting of accident information.
- Review reports of major accidents.
- Identify needed emphasis among the wildfire agencies concerning fire management policy, program direction, or training in order to improve firefighter safety.
- Develop a detailed, structured process for documentation of critical incidents in order to gain the maximum training benefits.
- Initiate specific recommendations for publications, posters, visuals, or other fireline safety materials, under NWCG sponsorship.

The Committee set as a priority task the development of a communication link for transmitting fireline safety information. A "Fireline Safety Gram" format was created, and the first of these notices, designed to detail critical fireline events that have occurred, has been prepared and forwarded to cooperating agencies. However, the major responsibility to date has been the Committee's active coordination of the new Firefighter Safety Course, "Standards for Survival," including conducting this session for western firefighters in Boise in June.

Continuation of the Wilson Study and the Fatal/Near Fatal Fire Accident Report was set as a major objective, to record fatalities that have occurred since their publication. A fire fatality data classification system has been developed, with the objective of identifying trends, areas that may need training emphasis, or changes in fire management policy, etc. The system will consist of two parts — one for fatal situations and the other for fireline near-miss events.

Clearly, if this committee is to achieve its goals, cooperation must be extended by NWCG agencies. A vast amount of critical fireline information is contained in fatality reports prepared by agencies that have suffered fire tragedies.

Efforts are now underway to have copies of fire fatality accident reports forwarded to the Fireline Safety Committee. Any reports or study papers prepared by this group will be shared with all cooperating agencies, but without revealing specific identities of agencies or individuals involved in deeply sensitive and tragic circumstances.

Following classification of the data, these reports detailing the Nation's forest and wildland fire tragedies will be forwarded to FIREBASE Archives at the Boise Interagency Fire Center for storage and retrieval when needed.

Firefighting is one of the most dangerous occupations in the United States. That is an established fact supported by somber statistics detailing fire tragedies. Certainly, any effort to reduce the hazards and minimize the risks involved in the fire environment is a worthy enterprise.

This renewed national emphasis on firefighter safety is a mission the entire forest and wildland fire suppression community can readily support.

An Evaluation of the Incident Command System

Clinton B. Phillips

Consultant in rural and wildland fire protection, Grass Valley, CA

Introduction

The California Department of Forestry contracted with the author to prepare a report of California's early-season wildland fires of 1985. That report, completed in March 1986, showed that between June 27 and July 20, 1985, there were 2,547 wildfires in California that killed three people, blackened 453,143 acres of wildland, destroyed 223 residences and damaged thousands of other structures. At the height of firefighting activity on July 10, 1985, at least 11,669 firefighters from California and several other States were involved in controlling the blazes. That activity placed extreme stress on the ability of the fire protection agencies to work together in an effective manner.

Although there were many factors that enabled the agencies to cope with the large number of wildfires, including California's Fire and Rescue Mutual Aid Response System, one important contributor was the relatively new Incident Command System (ICS). That system, developed by several partner agencies in southern California since 1972, was extended statewide only 2 years previous to 1985's conflagrations. It was still being extended to additional participating agencies when the wildfires of early 1985 provided its first severe, statewide test. How well did the ICS pass that test? The answer to that question can be inferred from the following recommendations made by knowledgeable participants and observers.

Summary of Recommendations for Improving the ICS

The author interviewed many State and Federal fire personnel and from those interviews developed the following summary of their recommendations:

1. Using agencies should establish joint offices for administration, dispatching, warehousing, and training. This will promote achievement of unity and trust among the personnel of these agencies.
2. Interagency training should be expanded almost to the exclusion of single-agency training in order to achieve unity of purpose and understanding, maximum effectiveness, and least cost for training. At the very least, there should be common lesson plans and training procedures available to all participating agencies.
3. Transitional training from old organizational systems to the ICS and skills training should be expanded to include everyone intending to participate in the ICS.
4. Training courses for incident commanders should recognize different levels of incident complexity; there should be separate courses for initial-attack incidents and for more complex, major incidents.
5. The use of trainees is a good concept and should be expanded.
6. To the maximum degree possible and practicable, the personnel of local fire departments should be included in ICS training.
7. ICS training should be expanded to States other than California as soon as possible; it is difficult to work in the ICS mode with firefighters who do not understand it.
8. Training should be supplemented by experience; both are needed to fully qualify a person to perform a specific job adequately.
9. Firefighters should be used primarily in the operations section, where they are most needed. Other personnel, volunteers, and retired persons can be trained to fill positions in other sections.
10. Incident commanders should not fill administrative positions too quickly because the organization can become unwieldy and use too many firefighters needed on the fireline. Incident commanders should rely more on their section chiefs to anticipate when they will be overburdened and need more staff people.
11. Command teams sent to major incidents should have a greater number of qualified people in the planning, logistics, and finance sections. There should be only one

procurement officer, however, to avoid duplication of orders from personnel of two or more agencies working together on an incident.

12. Fire prevention officers should be used primarily to investigate fire starts; other trained people should be used to work with the news media.

13. While agencies are still learning to use the ICS, they should assign advisors/evaluators to at least some large incidents to take an objective view of how the ICS is being applied and to offer assistance to the management team; incident commanders must be trained in the need for this position in the early years of using the ICS.

14. Coordination centers should have one or (at the most) two specific people assigned to each major incident being served.

15. Section leaders should be better identified both at the base and on the fireline.

16. The need for flexibility in making changes in the ICS at the time of an incident should be thoroughly explored by the using agencies and strict guidelines prepared for allowing such changes; the basic premise should be that the user runs the ICS, not vice versa.

17. Adaptations that were made to the ICS during the 1985 conflagrations should be documented and disseminated broadly for training other personnel.

18. As funding permits, all equipment should be standardized so that any qualified person from any agency can step into a given piece of equipment and feel comfortable at once about operating it; standardization should be applied to command trailers, communications vehicles, radios, engines, bulldozers, computers, etc.

19. Computer programs should be standardized and published for broad use; more programs should be developed where needed.

20. The ICS should be used at all times on all incidents.

21. The "paper jungle" of the ICS should be explored again to make certain that it is serving the user and not vice versa.

22. The need for a radio relay satellite should be studied and specifications prepared for the time that funds may become available for providing such a satellite.

23. The value of cellular telephones on certain incidents should be studied.

24. More radio caches should be provided.

25. More discipline in the use of radios on incidents should be enforced.

26. At each base there should be a separate bulletin board for at least each branch of the operations section.

27. When two or more agencies are involved in a major incident, they should write a memorandum of understanding that delineates how the incident's expenses will be shared; such memoranda should be published and used broadly in training sessions.

28. More people need to be trained in the finance function; this training should cover how to work on the fireline with personnel of the operations section in proper hiring, timekeeping, etc.

29. Every major incident should have a medical unit staffed by professionally qualified medical personnel.

30. Commitment and accountability should be emphasized in training and at the incident; if they don't exist on an incident, the organization and operations can break down quickly. ■

Identifying Federal Property

This distinctive yellow vinyl label is used to identify Federal property on loan to the States for fire protection. There are regulations that Federal property be identified. Several States, such as Washington, Nevada, Oklahoma, have developed their own identification tags and labels for this purpose; this shows a commitment by those States to properly manage this property on loan to them.

Recently an aluminum tag with the same message as the yellow vinyl tag was made available to State forestry agencies for use where the vinyl labels are unsuitable. The aluminum tags can be riveted, nailed, glued, or screwed on greasy equipment or in weather conditions where the vinyl tag would freeze, shrink, curl, or not stick. ■

BLM and Forest Service Radio Caches Combined

Charlene Lidgard

Bureau of Land Management, Boise Interagency Fire Center, Boise, ID

The Forest Service's National Fire Radio Cache (NFRC) and the Bureau of Land Management's National Radio Support Cache (NRSC), located at the Boise Interagency Fire Center, are doing business more efficiently these days since being integrated into one centralized cache. This convergence of emergency incident communications systems from both agencies has been renamed the National Incident Radio Support Cache (NIRSC).

The NIRSC has taken the best from both the NRSC, which began operations in 1966, and the NFRC, which started in 1973, to better serve the field in the area of emergency communications. Under the old system the Forest Service had what was known as a Large Fire Radio System, which consisted of 14 boxes of equipment. On many incidents, some of this equipment was never used. The BLM used a system of modular kits. In this instance, only what was ordered by the field was shipped to the incident. Both systems had their shortcomings. What was needed was some type of standardization of operation and management of one centralized facility. Adoption of the National Interagency Incident Management System (NIIMS) and its Incident Command System (ICS) led to a common organization among wildland fire suppression agencies at the local, State, and Federal level. NIIMS and the Forest Service's Incident Communications Study (1986) provided justification to merge the NRSC and the NFRC into one operation.

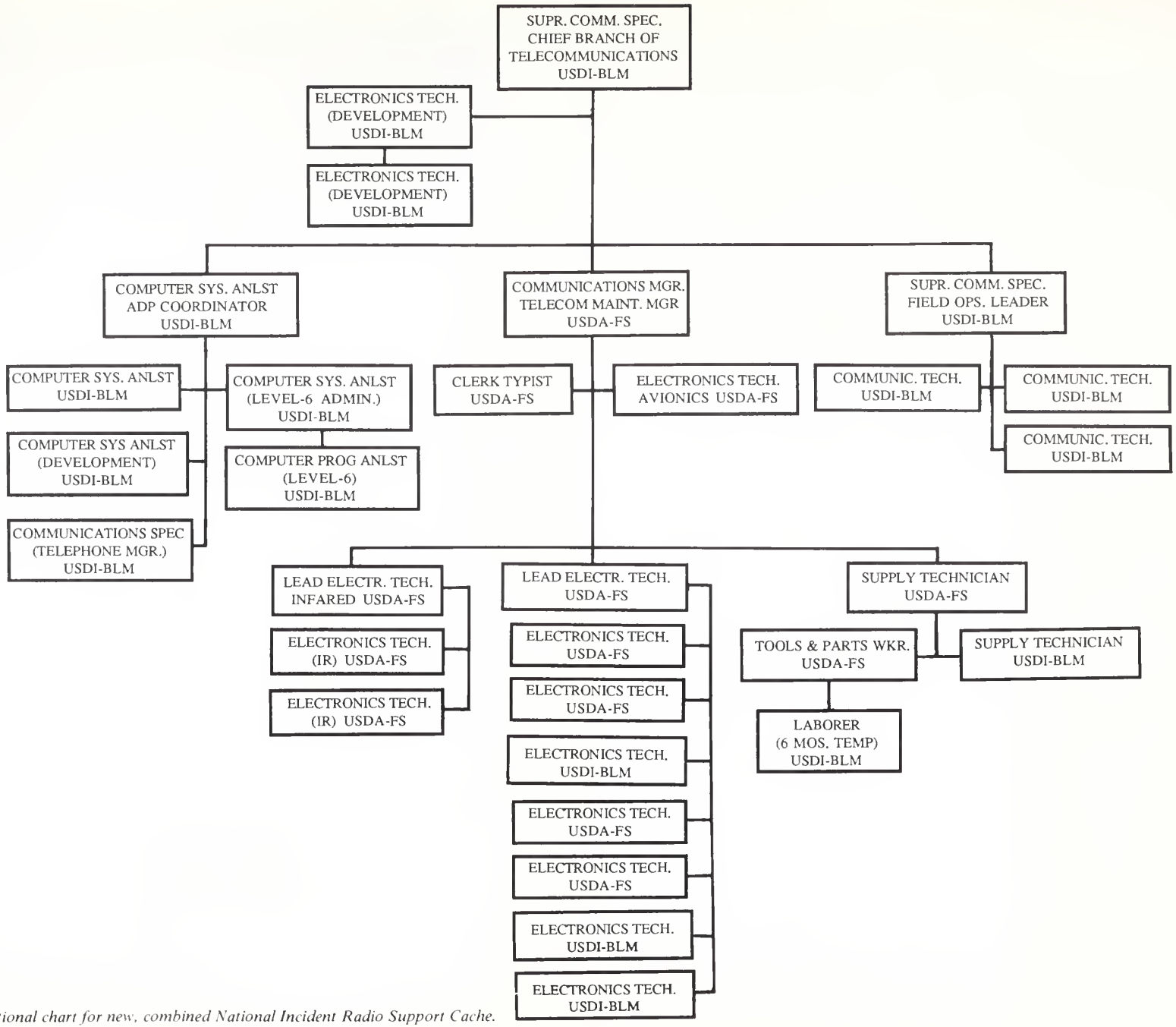
On November 14, 1985, the Forest Service Director of Fire and Aviation Management and the BLM Assistant Director for Technical Services entered into an agreement to explore the possibility of a joint fire communications organizational effort at BIFC. The basic objectives included:

- A more responsive and cost-effective fire communications and electronic program for both agencies.
- Potential cost savings.
- Elimination of duplicative efforts.

A study team was formed early in 1986, consisting of the following people: Bill Baden, USFS-BIFC, Co-chairman; Roy Percival, BLM-BIFC, Co-chairman; Les Helms, USFS-BIFC; Duane Herman, BLM-BIFC; John Warren, USFS R&D, WO; Ken Reninger, BLM-BIFC; Steve Werner, USFS, WO; and Jerry Rauscher, BLM, WO. Through a series of meetings and information gathering sessions, a study with alternatives was completed and submitted to the BLM and the Forest Service for approval on July 21, 1986. A joint review of the study report was conducted by the Washington Offices of the two agencies. On September 24, 1986, the Forest Service Director of Fire and Aviation Management and the BLM Assistant Director for Support Services approved the recommended study alternative and directed operational implementation. A detailed implementation plan was jointly prepared, addressing organizational structure, personnel supervision, program direction, management, training, and funding. The implementation plan was approved in July of 1987.

The National Incident Radio Support Cache provides for the standardization of radio equipment; this makes the existing radio equipment more compatible for easier use in the field. The cache employs both Forest Service and Bureau of Land Management electronics technicians and has a combined shipping/receiving and supply system, infrared operations section, and an avionics section. The cache has one supervisor, which makes for a more efficient operation. Also housed in the 8,400 square foot facility is the BLM Remote Automatic Weather Station Depot Maintenance Facility, a Field Operations Group, and a Cache Research/Development Section. The centralized facility has eliminated one and one-half positions, provides for cross-training the technicians in all aspects of cache operations, and has so far saved approximately $125,000 by reducing the need for testing equipment and radio parts.

Future plans include modifying the cache equipment so that BLM equipment can interface with Forest Service radio systems and vice versa. This modification, with the field's approval, will give Communication Unit Leaders more versatility when planning emergency communications systems on incidents. An integral part of this concept is the formal sharing of frequencies between the agencies. The Forest Service and the BLM are currently drafting cooperative



Organizational chart for new, combined National Incident Radio Support Cache.

Natalie Wiklund, BLM, and Bill Parham, FS, working together as part of the combined FS/USDI National Incident Radio Support Cache (NIRSC).

agreements to include each other's frequencies on their respective radios. These frequencies will be used **only** in support of emergency operations and will be coordinated at BIFC through the Communications Duty Officer. The Communications Duty Officer (BIFC) will work closely with the field and with the Regional Coordinators on frequency management, equipment compatibility, and systems design.

Other plans include the development of one catalog for ordering radio equipment. This will be included in the National Fire Equipment System Fire Supplies and Equipment Catalog and should simplify the ordering process for the field.

The author, with the satellite-to-earth station and computer that became operational during the 1986 fire season.

The National Incident Radio Support Systems are used not only on fires, but have been and are being used by Government law enforcement agencies, the Nuclear Regulatory Commission, the Forest Service's Pest Management Program, and will be providing assistance to U.S.-AID, Office of Foreign Disaster Assistance for international emergency assistance. ■

The Grid-Compass lap-top computer being used in remote fire locations.

Prescribed Burning in Michigan[1]

Ronald L. Wilson

Forest Management Division, Michigan Department of Natural Resources, Lansing, MI

Introduction

Prescribed burning is the skillful application of fire to natural forest fuels under exacting conditions in a predetermined area with the accomplishment of certain planned benefits to one or more objectives of forest management, wildlife management, or hazard reduction. The basic objective of such burning is to employ fire scientifically in order to maximize benefits.

Prescribed burning is a valuable silvicultural tool that is used in many different ways in managing Michigan's natural resources. In the early 1930's, the Michigan Forest Fire Experiment Station conducted experimental controlled burns to determine the influence of fire on blueberry production. In the late 1940's, controlled burning was proposed for the creation and maintenance of large grass openings as sharptail grouse and prairie chicken nesting habitat.

There were some factors that tended to limit this burning program: The public had been educated to the devastating effect of all forest fires and the need to reforest wildland openings; many areas of second growth had reached the stage where fire would not burn them effectively without creating hazardous fire conditions; and there were only a few days in the burning season and a few hours in those days when the desired effects from a fire could be accomplished. These factors are still with us today.

In the 1970's a major development occurred in Michigan's burning program. We went from controlling fire on a specific area to determining the objectives we wanted to accomplish with fire and prescribing the weather, fuel, and ignition parameters needed to meet those objectives. The expansion of Michigan's deer habitat management program and the development of the Kirtland's Warbler recovery program in the mid 60's and early 70's led to the need for an expanded and improved prescribed burning program.

Large areas were set aside for research to determine optimum deer habitat. Areas as large as 25, 50, and 75 percent of a quarter township were clear cut and the slash was treated in different manners, of which prescribed burning was one. Our fire managers were told they were to burn under very diverse fuel and weather conditions to determine the fire effects and also the ability of our organization to burn under very hazardous conditions and still be able to control the fire. New burning techniques, an awareness of fire behavior, and a confidence in the abilities of Michigan's fire control organization were developed during this increased prescribed burning activity. The relationship among weather, fuel conditions, and fire behavior was integrated into the prescribed burn planning process. Ignition and control techniques were developed. And an effective prescribed burning program emerged.

Program Objectives

There are four major objectives in our prescribed burning progam.

- Forest management
- Wildlife habitat management
- Hazard reduction
- Training fire control personnel

These four major categories are broken into many specific species areas. These specific areas are quite often interrelated and more than one objective can be accomplished on a single burn.

Specific Species Objectives

Prescribed burns in jack pine cover type are some of our most hazardous burns —yet the benefits are great. This type is good whitetail deer habitat as well as the essential nesting habitat for the endangered Kirtland's Warbler. Well-defined prescription parameters, good control lines, and a disciplined and controlled ignition are necessary to safely accomplish burns in this very flammable fuel type. Burning reduces slash, prepares seedbed for natural seeding or planting, and increases plant species diversity, which make the area more desirable for wildlife. These Jack pine burns also increase the production of blueberries, which are used by people as well as wildlife.

Prescribed burning for the enhancement of blueberry production is done in several areas. Most of these areas are a mixture of lowland bog with low sandy ridges or hummocks. Pruning by fire stimulates succulent new growth and fruit production that is heavily browsed by deer, and the fruit is used by wildlife as well as people.

[1]Reprinted from Proceedings of Symposium on Prescribed Burning in the Midwest: State of the Art, Stevens Point, WI, March 3-6, 1986.

Northern white cedar is important for winter browse and cover for deer. Some prescribed burning has been done in this type with varying results. Research conducted by Louis J. Verme (unpublished report) from 1974-84 near Shingleton, MI, indicated that burning would be in order following clearcutting where (1) there is little or no advance reproduction of white cedar, (2) thick slash deposits will occur, (3) a heavy component of deciduous brush is present, and (4) the site may naturally convert to other less desirable conifers.

In recent years such burnings have been accomplished to improve waterfowl habitat in Michigan. Cattail marshes become choked with dead vegetation and hinder the passage of birds in the area. When these mats are burned the marsh is opened up with interspersed water openings and used much more heavily by ducks, geese, and muskrats. Most of this marsh burning is done near the large metropolitan areas in southeastern Michigan.

In northern lower Michigan, a research project in red pine underburning is being conducted. This is in Michigan's elk herd range. The stand was established in 1931 with a mixture of red, white, and Jack pine, with all but the red pine removed in 1970. This left around 50 to 60 feet basal area remaining, which quickly filled in with hardwood regeneration that was excellent browse for elk. Prescribed burning is now being used to keep the stand as a red pine stand and maintain a hardwood understory as browse.

This research will give us a set of prescription parameters that will reduce the understory to age zero but not damage the small sawlog red pine trees. The most recent different type prescribed burning is being done to improve pheasant nesting and brood rearing habitat on "mini-game areas" in Michigan's thumb area. The early spring burns reduced the accumulation of dead vegetation and enhanced the early growth of legumes. This made it easier for young chicks to move about and feed on the insects living on the legumes.

Accomplishments

Many acres have been treated since the beginning of controlled burning in Michigan. From the early 1940's to 1971 over 25,000 acres were burned to improve habitat for various species of wildlife. Most of these burns were for improving or maintaining habitat for sharptail grouse and prairie chicken in the Upper Peninsula or the northern Lower Peninsula.

Treatment of areas for the development of Kirtland's warbler habitat has been a high priority with varied degrees of success. We have burned 3,700 acres in this program with an average cost of $18.67 per acre.

The increasing emphasis on the improvement of existing waterfowl habitat has helped us develop our prescribed burning in cattail marsh. Most of these burns are in the winter and require a minimum of control effort, which gives us the ability to increase our acreage burned and greatly reduces the cost per acre.

We have treated 9,200 acres for waterfowl habitat with an average cost of $1.87 per acre. This habitat type is by far the least expensive to treat, with one burn costing only $.18 per acre.

Prescribed burning for blueberries has received interest throughout the State. Since the early 1970's we have burned 4,000 acres at an average cost of $5.96 per acre.

Hindrances

There are several obstacles that have to be overcome to accomplish our program goals. Workloads in other programs or job priorities have to be sorted out.

Meeting the prescription weather parameters is sometimes difficult to do—not only in the summer or fire weather periods but also in the winter. The marsh fuels need 4 or more days with continuous below-freezing temperatures to dry the fuels so they will burn. The fuels cannot be snow-covered and the ice must be safe to hold up people and snowmachines. The wind should be over 8 mph to carry the fire in marsh fuels. Smoke management on these burns is critical because of the proximity to large metropolitan areas, major airports, and major highways.

Prescribed burning during the fire season is also limited by prescription parameters and the availability of burning crews because of the responsibility for wildfire protection.

A study of 5 years of fire weather records by Donald Grant in 1973 indicated there would be about 20 days available in a year for prescribed burns in the volatile Jack pine fuels. This can be extended a few days if a "cool" prescription is acceptable.

Summary

Prescribed burning in Michigan continues to be a valuable tool in managing our natural resources. It is economical to use and in some instances is the only viable alternative to accomplish certain management objectives. With the continued importance of timber production, wildlife habitat management, and training fire suppression forces, prescribed burning will be an important part of Michigan's forest management operations. ■

Two-Hundred-Year-Old Fire Prevention Message

So you think fire prevention is a new idea? Well, reading the January 1987 issue of the *Journal of Forest History* gave me some food for thought. An article entitled "The Moravian Foresters" by Coleman A. Dogget points out several interesting fire prevention facts. The article itself is an interesting view of the Moravian Church and their settlement in North Carolina in colonial times.

The Moravian Church is a Protestant Christian denomination tracing its origins to the 1400's. A large number of the believers came from the province of Moravia in present-day Czechoslovakia, so the church came to be known as the Moravian Church. The article in the *Journal* outlines the practices of Moravian foresters as they established their central North Carolina commune in the mid-1700's.

Dogget points out that "Although there was considerable effort made to plant trees in towns, there is little evidence that the Moravians planted trees in the forest." There was some discussion of forestry planting in 1792: "There is almost no wood at the Northeast corner of the Salem land and it would be well to plant the seed of yellow pines there, only we are afraid that bush fires will prevent their coming up."[1]

In yet another reference, the article notes: "Forest and bush fires were a constant problem in the colony. Not only the trees, but the houses and the split-rail fences were susceptible to fire. It is not surprising then that the Moravians actively attempted to prevent fires as well as put them out once they started."[2] In 1759, the town authorities "had a conference about forest fires and agreed to make every effort to preserve several pieces of fine young woodland."[3] In 1776 "Brother Reuter gave a waggoner a permit to hunt on our land on condition . . . that he would not build a fire in the woods, or at least carefully extinguish it." [4]

So there it is, reference to the need to prevent fires to allow for productive forests, and the reference to what we 200 years later are calling the "urban-wildland interface." In addition, we could draw references to fire prevention conferences, burning permits, stage restrictions, fire prevention messages, and a raft of other tools we use today. Still the importance of fire prevention has not diminished. It was important to the Moravians 200 years ago, it's important to us now!

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[1] Adelaide L. Fries, Kenneth G. Hamilton, Douglas L. Rights, and Minnie J. Smith, eds., *Records of the Moravians in North Carolina,* 11 vols. Raleigh: North Carolina Historical Commission, 1922, p.2371.

[2] Ibid., p.2388

[3] Ibid., p.1083

[4] William Hinman, "Phillip Gottlieb Reuter, First Surveyor of Wachovia," Master's thesis, Wake Forest University, 1985, p.43.

Submitted by Tom Harbour, District Ranger, Big Valley Ranger District, Modoc National Forest. Member, California Inter-Agency Fire Prevention Committee. ■

Computers and Satellites on Fires

Natalie Wiklund

BLM Division of Information Systems Management, Boise, ID

The USDI Bureau of Land Management (BLM) at the Boise Interagency Fire Center (BIFC) has been providing hardcopy data transmission capability from fire camp to a service center for 5 years as a continuing feasibility/development effort. This project was begun because of the inefficiencies of using voice for transmission of fire orders and summary reports. The voice method of transmission is characterized by high numbers of transcription errors and is very time consuming. Data transmission provides the exact same hardcopy on both ends—thereby eliminating the transcription errors—and cuts the transmission time involved by about two-thirds. The data transmission system prototype consisted of two Texas Instrument Silent 700 terminals, BLM/BIFC constructed modems generally used a radio network for the communications medium. Phone lines were used for communications, when available, as an alternative to the radio network to conserve the finite number of radio frequencies. The Silent 700 system, as a starting point, provided data transmissions, but was very limited. Its small memory did not allow for archiving data, and it could not do sort functions. A search was made to locate a computer with full processing capabilities that would handle the harsh environmental aspects encountered in a fire camp. Research was also begun on the feasibility of using a satellite network for both voice and data transmission as an alternative to radio and telephone communications.

The extreme 1985 fire season yielded an opportunity to purchase and field test a GRID computer system. The GRID computers are rugged, portable systems that include a terminal and a 10 megabyte hard disk and floppy drive storage system to which we tied a Hewlett-Packard Think-Jet printer. This computer system appeared to meet the environmental constraints (heat, cold, dust, humidity) placed on a system that would be required to function in a fire camp.

We spent 4 days learning to operate, developing programs and interfacing the GRID system to an Army satellite communications system, and immediately placed the system on the French Creek Fire on the Payette National Forest, ID. This computer system itself functioned remarkably well, processing and transmitting fire orders, the daily summary, and general communications. The system also achieved a listing of resources and personnel on the incident for tracking purposes. We anticipated being able to interface the GRID to a Forest Land Information Processing System (FLIPS) unit in the McCall SOCO to transfer information to the Regional Office. Because of software mismatches this was not accomplished as effectively as hoped. The Army satellite system experienced some problems due mostly to frequency allocations but still proved that satellite communications was a viable idea.

A portable satellite transceiver system was purchased early in the 1986 fire season. This system uses a maritime satellite that operates on a frequency that allows use of a much smaller dish than other systems. The entire package consists of two suitcase size cases that weigh about 60 pounds apiece. Set-up time, from arrival to operation, including computers, is about 20 minutes. This satellite system and the GRID computers were interfaced and deployed to three Alaskan and two Oregon fire emergencies for a total of 7 weeks of field time in 1986.

The system proved its worth by providing point-to-point communications in Alaska, where this is

sometimes quite impossible. The portable TCS-9000 system is an appropriate system for Alaska because the $10-$20 a minute satellite charge is not out of line with regular telephone costs.

On the Oregon incidents, the satellite/computer communications system was almost the first item in the fire camp, providing for logistics communications as the camp was being mobilized. Although the date and telephone contact with the outside was still a positive influence, it was the immediacy of operations of the portable satellite system that proved its effectiveness. The cost of operating the TCS-9000 portable satellite system is the only drawback.

We also leased another satellite system for the Garden Valley complex. This system has a trailer-mounted 27- meter dish. It is not as portable as the other system, but in the lower 48 States, where most incidents can be reached by road, it should prove to be entirely adequate. The costs for this system are lower, and so offset the less desirable size. This system was tied to a Forest Service Data General computer system.

During the last two fire seasons, satellite and computer communications have proven to be an effective tool. Research will continue and in the future many aspects of fire management can be automated. Computers in camp can provide access to AFFIRMS, weather information, fire behavior, and modeling programs in addition to the processing and communications required by the camp management. ■

Wildfire Diary

Assembled by Dorothy H. Terry

Incident Information Officer, Wallowa-Whitman National Forest, Baker, OR

(From reports, articles, and information provided by Bill Waterbury, Burnt Powder Zone Fire Management Officer; David Anderson, Fire Management Staff Officer; Gay Brockus, Public Affairs Specialist; Charles Ernst, Range/Fish & Wildlife/Watershed Staff Officer; Terry Porter, Budget & Accounting Officer, all from Wallowa-Whitman National Forest; and USDA Forest Service Region 6 Incident Information Officers Warren Olney, Mike Ferris, Pauline McGinty, Norm Hesseldahl, Joe Meade, Deanna Riebe; Dick Harlow, Lakeview District BLM II0; USDA Forest Service Region 6 "Greensheet.")

The morning of Saturday, August 2, 1986, the National Weather Service Office in Pendleton, OR, said, "A very, very weak low will pass across Oregon today. . .but it still has enough energy to increase the chance of isolated mountain showers and thunderstorms even though moisture will be very limited." That afternoon, the Pendleton office said, ". . .there is significant lightning activity, but little if any significant rainfall with the storms." Temperatures were in the 80's and 90's, with variable winds at 10 to 20 mph, and relative humidity ranging from 10 to 20 percent.

In late July and early August of 1986, northeastern Oregon had experienced a period of hot dry weather, resulting in extremely dry fuels. The majority of annual/perennial grasses and herbaceous plants had already cured; fine-fuels moisture was as low as 3 percent. The extent of the dry period was indicated by the 1,000-hour fuels dropping to 10 and 11 percent across the 2.4 million-acre Wallowa-Whitman National Forest.

The objective language of fuels moisture analyses and twice-daily weather reports cannot begin to describe the feelings and sights of that hot, dry, windy, dusty Saturday afternoon throughout this corner of Oregon. Hundreds of lightning strikes seemed to come at once, flashing across the horizon of the Elkhorn Mountain Range, into the foothills, striking onto dry high-elevation forest, sagebrush hills and open range in hundreds of places — nearly simultaneously. **NO** rain accompanied the lightning strikes.

Within minutes, dozens of fire reports started coming into the Burnt Powder Fire Zone in Baker — from lookouts, observer planes, private citizens. The storm started these fires in a 70-mile semi-circle from 6,900-ft Chicken Hill on the north, to the southwest and south of the town of Baker, and south to the small town of Unity, 50 miles away from Baker.

By evening of that day, 300 fires had been reported on lands under the fire protection jurisdiction of the Wallowa-Whitman and Malheur National Forests, the Oregon Department of Forestry, and the Bureau of Land Management. During the night, many successful initial attacks were made by the men and women of local interagency crews, but in spite of their efforts, the number of fires grew beyond their capability, and reinforcements were requested.

By Sunday morning, with the dry lightning and gusty winds continuing, a number of fires had grown to Class B or above, including eight major project fires within a 25-mile radius of Baker. (Hundreds of ranches, rural residences, summer

First dry lightning storm over the Baker Valley, August 2, 1986, which started hundreds of fires on the Wallowa-Whitman, Malheur, and Umatilla National Forests in northeast Oregon. The lightning storm moved on into Idaho and started numerous fires there.

cabins, occupied mining claims, campgrounds, logging operations, historic sites, and a ski area are within this half-circle. The small towns of Sumpter, Granite, and Unity were all close to the fires.)

On Sunday afternoon, more weather instability was causing extremely erratic fire behavior, forcing indirect suppression tactics. The Forest's Class II overhead team and an Oregon Department of Forestry team were in place on the Dark Canyon, Sunflower, and Cottonwood fires south of Baker, near a number of rural residences and ranches. The Olympic National Forest Class II team was en route to assume command of both the Eagle and Lost Cow fires near the town of Unity.

Late Sunday afternoon, travellers on Interstate 84, heading northwest from Boise, could see at least four major smoke columns from as far away as 60 miles; these columns were estimated to be higher than 40,000 feet. A few miles south of Baker on the interstate, sagebrush, juniper, and ponderosa pine burned not 50 feet from the highway.

Sunday evening, Wallowa-Whitman Forest Supervisor Jerry Allen, working with Baker District Ranger Glenn McDonald, Unity District Ranger Bud Flint, and Fire Staff Officer Dave Anderson, determined that the multiple large fires required an Area Command Team to manage the fire situation, and to relieve local personnel.

During the night the decision was made to order four Class I overhead teams (now called "National Teams" under the Incident Command System). These teams would manage the Huckleberry, Cornet, Sunflower, and Cottonwood fires. All four of these rapidly spreading fires posed a threat to structures and other private property.

Supplies and crews began arriving on August 4, with incident command posts set up at Phillips Lake, Unity High School, Bridgeport and in the town of Sumpter. By Tuesday, August 5, suppression was organized and functioning well, with nearly 1,400 interagency men and women working all aspects of the fires—firefighting crews, overhead, command teams, aerial and ground support equipment, supply, logistics, EMT's, information, financial support.

About 2 o'clock Tuesday afternoon, a new fire, later to be named the Clear Incident, spread to 500 acres from Saturday's initial lightning strikes around Chicken Hill, near the Anthony Lakes complex of ski area, summer homes, and a newly reconstructed campground, about 22 miles northwest of Baker. Another Class I team was assigned to manage this fire. An 84-square-mile area, surrounding the Anthony Lakes Ski Area, was closed to pedestrian, horse, and vehicle traffic. All public access to roads and trails within the area was restricted. Some summer homes were voluntarily evacuated. Flame lengths in the high elevation subalpine fir and lodgepole pine were estimated to be 300 feet, creating their own weather patterns.

That evening, the area command was restructured to form a unified area command, with shared responsibility between the Oregon Department of Forestry, Bureau of Land Management, and USDA Forest Service, headquartered at the Burnt Powder Fire Zone compound in Baker.

An area commander is responsible to the agency line officers and managers, and the team is responsible for setting strategy, priorities, and coordination. Tactics for managing incidents remain the responsibility of incident commanders.

Objectives and management philosophies utilized by the Baker Unified Area Command included:

- *Equal authority for all three command coordinators.*
- *Operate on a strategic basis only; do not become involved with incident suppression operations or tactics.*
- *Act as facilitators, strategic priority setters.*
- *Keep the three agency line officers informed and involved.*
- *Do not place report demands on incident commanders. (Basic maps and the IC Incident Status Summary Form 209 reports will meet most BUAC needs.)*
- *Maximize BUAC effectiveness by using the person with the highest chance of success dealing with IC's, agencies, and local problems.*
- *Keep it simple.*

A first-ever "unified command center" was later set up in the State capitol at Salem to lead the multi-million dollar battle by some 8,000 firefighters throughout Oregon. The UCC was staffed by USDA Forest Service, USDI Bureau of Land Management, and Oregon Department of Forestry personnel. The

Spectacular fire in crowns of subalpine fir trees on the Clear Fire, in the Blue Mountains of northeast Oregon, near Anthony Lakes Ski Area—about 30 miles northwest of Baker, OR. (August 1986).

new fire organization system, of which incident command centers are a part, was implemented in March 1984. The system—known as NIIMS, National Interagency Incident Management System—had been used successfully on a smaller scale in Region 6 of the Forest Service for two fire seasons before getting its hardest test in 1986.

A unified area command transition team was established in Baker on August 8 to set up standards and organizations to take over fires once they were at the mop-up stage. This unusual organization and procedure was established because of the number of contained/controlled fires the Forest would need to "take back" from the various off-Forest fire teams.

At the peak of activity during the week of August 3, 3,795 people were involved in the firefighting efforts on the Baker Unified Area Command.

By Saturday, August 9, seven of the BUAC fires were controlled, and the Clear Fire was contained. The situation had stabilized and plans were made for reassignment or demobilization of some of the dozens of crews.

The estimated final fire acreages for the eight project fires in this command were: Blue Canyon, 220 acres; Clear, 6,140 acres; Cornet, 2,130 acres; Dark Canyon, 1,300 acres; Eagle, 315 acres; Huckleberry, 11,400 acres; Lost Cow, 670 acres; Sunflower/Cottonwood, 5,130 acres. (Additional acreages outside the National Forest boundaries in the BLM and private ownership are not included in these figures.)

Second Lightning Bust Hits

Sunday afternoon, August 10, Phase II of northeast Oregon's "summer of fire" started when, in a very few hours, another severe dry lightning storm brought an incredible 2,271 lightning strikes to northeastern Oregon, covering the Vale BLM District, the Wallowa-Whitman, Umatilla, and Malheur National Forests, and adjacent private lands protected by the ODF.

This storm resulted in over 200 new reported fires.

Resources already involved in large fire suppression and mop-up were transferred back into initial attack in the immediate vicinity of past fires in the Baker area and into areas of new fires in the Wallowa Valley, about 70 miles northeast of Baker. (The new lightning storm was so severe at the Clear Fire near Anthony Lakes that crews were pulled off the firelines. A "mini-tornado" came through Clear Fire Camp, scattering papers, maps, supplies.) Of the six Wallowa-Whitman Ranger Districts and 648,000-acre national recreation area, only Pine District, south of the Eagle Cap Wilderness, remained relatively unaffected by the new fire strikes.

To indicate the severity of the situation of Sunday evening, August 10, the Wallowa Valley zone fire management officer said, "By late Sunday afternoon, we had manned five or six fires. Our resources were thin. Flying over the million-acre-plus Hells Canyon National Recreation Area (HCNRA), Eagle Cap and Wallowa Valley Ranger Districts, we had identified at least 20 significant fires by dark; during the night dozens and dozens more were reported. Another lightning storm on Monday brought the total of significant fires to at least 75." The Idaho portion of the HCNRA also had strikes and fires, including the 12,000-acre Little Granite fire in the Hells Canyon Wilderness. In the daily report from the Boise Interagency Fire Center came the statement not often seen by fire people: "All resources committed."

On Monday, the BUAC team met with local agency people to prioritize resources for managing fires on lands north of Joseph and Enterprise, to select a plan for management of the multiple, large-fire situation there. Working together, Wallowa Valley District Ranger Frank Olson, Eagle Cap District Ranger Bob Casey, and HCNRA Project Manager Al Defler, agreed to form a second unified area command for fires north and east of Joseph and to place orders for additional fire teams. The two ODF teams and two Class I interagency teams in place north of Joseph agreed that the developing situation would need numerous additional forces.

The Baker Unified Area Command now managed two fire complexes—North Fork and La Grande. Three incident complexes were set up on the adjacent Umatilla Forest—Granite, Desolation, and Tower. The newly organized Wallowa Unified Area Command was divided into the Grossman, Kuhn, Joseph, Buckhorn, and Imnaha Incident complexes, each of which had multiple large fires to be managed by an interagency incident command team.

Additional and unique problems presented by the large fires in the Wallowa Unified Area Command were compounded by the extremes of terrain (Hells Canyon and Joseph Canyon range from 3,000 to 5,000 feet deep, with 50 to 80 percent slopes). Congested air traffic going into the tiny Joseph and Enterprise Airports, often 150 arrivals/departures per day, presented major challenges until the FAA moved in to install a mobile air traffic control tower. Heavy smoke from the fires, from field burning and an inversion hampered accurate mapping of fires and contributed to the concerns of rural residents and people in the small towns of the Wallowa Valley. Logistics involved in the transfer of crews and overhead into the camps contributed to the complexity; a second expanded dispatch organization to support the fires in the Wallowa Valley was set up at the La Grande Fire Center, 60 miles west. The number of fires burning near boundaries of the Eagle Cap and Hells Canyon Wildernesses presented problems to decision makers: contain, control, confine? And some fires were burning in privately held rural areas outside the boundaries of any fire protection jurisdiction.

Over the mountains to the west of the Wallowa Valley, Mt. Emily stands sentinel over the town of La Grande and the Grande Ronde Valley. At the foot of the mountain are a number of rural residences—small ranches and farms, most with valuable homes and outbuildings. The strikes of August 10 also started a fire on the lower slopes of Mt. Emily, threatening these homes, some of which were voluntarily evacuated by their owners. Volunteers and rural fire departments from the adjacent communities played primary roles in preventing the spread of this relatively small, but potentially disastrous, fire from spreading into the populated areas

at the base of the mountain. A Class I team, based at Eastern Oregon State College in La Grande, managed this Frizzell fire, as well as numerous other La Grande Complex fires.

Also in the La Grande Ranger District, a number of strikes and fires were reported in the Mt. Fanny and Mt. Moriah areas, to the east across the Grande Ronde Valley from Mt. Emily. Dozens of other fires were scattered south and west nearly 60 miles to the southernmost Forest boundary near the small mining town of Granite and on the adjacent Umatilla National Forest.

On August 17, 5,741 men and women were involved in fire suppression efforts on the Wallowa-Whitman in all the complexes, at the La Grande Fire Center, and at the Supervisor's Office in Baker. Eight retardant aircraft were used from the La Grande Fire Center and from Grangeville, McCall, and Boise, Idaho. Thirty-five light, medium, and heavy helicopters were in use. Communications included radios, radio telephones, satellites, and telephone hookups from six different regional phone companies and from the Oregon Army and Air National Guards. Computers were hooked up in nearly every fire camp. All nine Forest Service Regions participated; 106 National Forests were represented. The population of Baker County was increased by 50 percent and Wallowa County's population was doubled.

By August 18, the fire situation had stabilized in the BUAC, leaving only the Clear Fire complex with off-Forest teams. The WUAC fire situation began to stabilize on August 20, when weather conditions helped cool the fires. The incredible job of getting 5,000 people back to their home units was begun in earnest, but some mop-up operations lasted until well after Labor Day.

Estimated final acreages for fires started by the August 10 lightning strikes were: Roberts Butte, 1,175 acres; Kuhn, 750 acres; Middle Point, 2,620 acres; Fire Ridge, 860 acres; Joseph Canyon and Starvation Creek (burned together), 26,600 acres (all in Wallowa Valley Fire Zone, and on BLM and private lands). In the La Grande Complex: Frizzell, 670 acres; Pine Butte, 145 acres; Spring Creek, 440 acres; Three-Cabin Ridge, 205 acres. In the Hells Canyon National Recreation Area and adjoining private lands: Sheep Divide, 1,300 acres; Corral Creek, 1,380 acres; Grouse, 1,450 acres; Little Granite (Idaho HCNRA), 12,020 acres; Middle Ridge (Idaho HCNRA), 1,250 acres; Pumpkin, 14,050 acres.

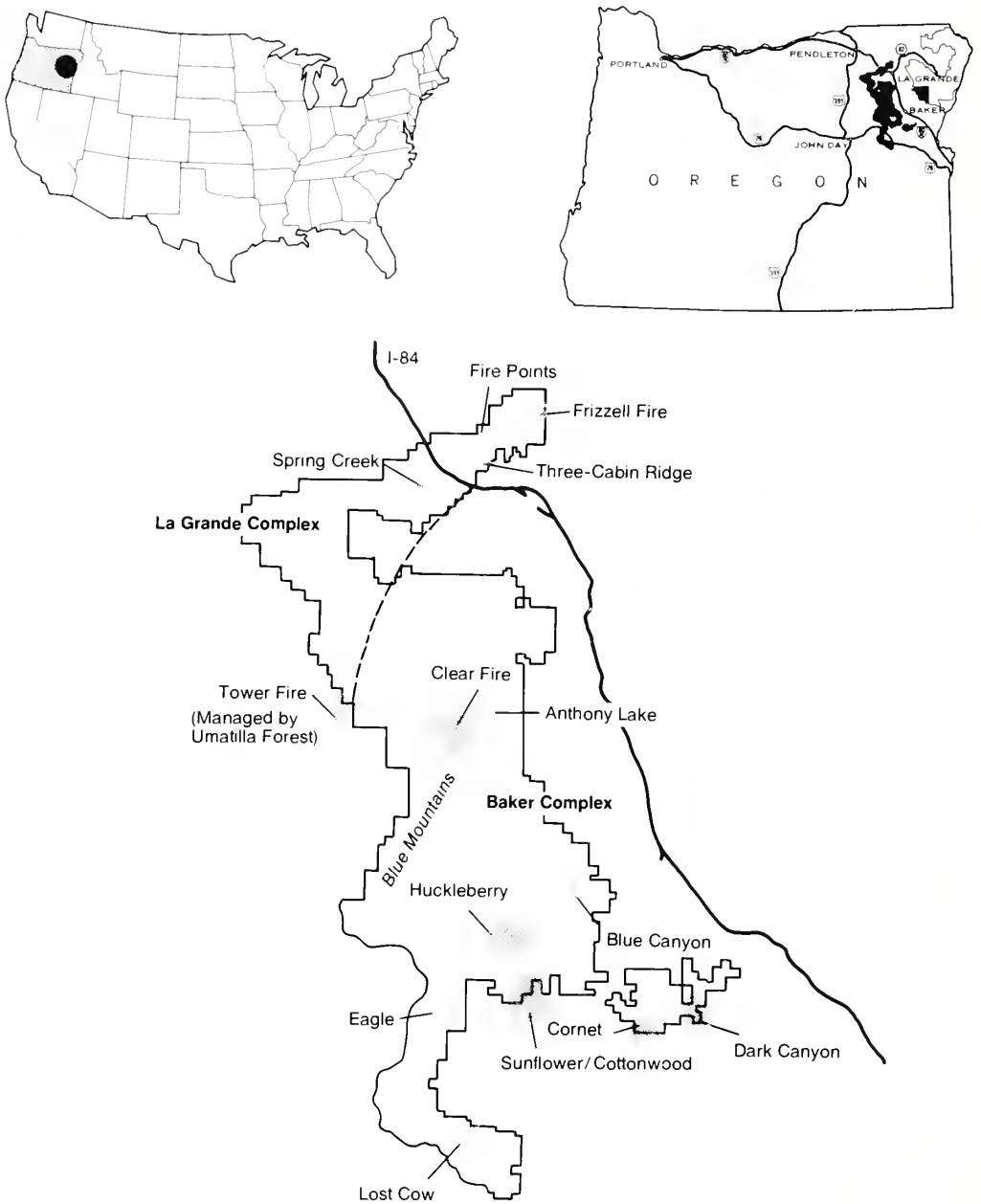
The total estimated cost of fire suppression on this National Forest in August of 1986 reached $22,866,000, not including the costs of out-of-Region transportation of fire crews and overhead.

Fires Affect All Plant Communities

Lightning strikes started fires at nearly all the elevational zones on the Forest, from about 1,300 feet in Hells Canyon to 7,800 feet near Anthony Lakes. Fires affected all vegetative models represented on the Forest, with predictably mixed results. Soil structure in a number of watersheds was altered in varying degrees, depending on intensity of burns, requiring watershed rehabili-

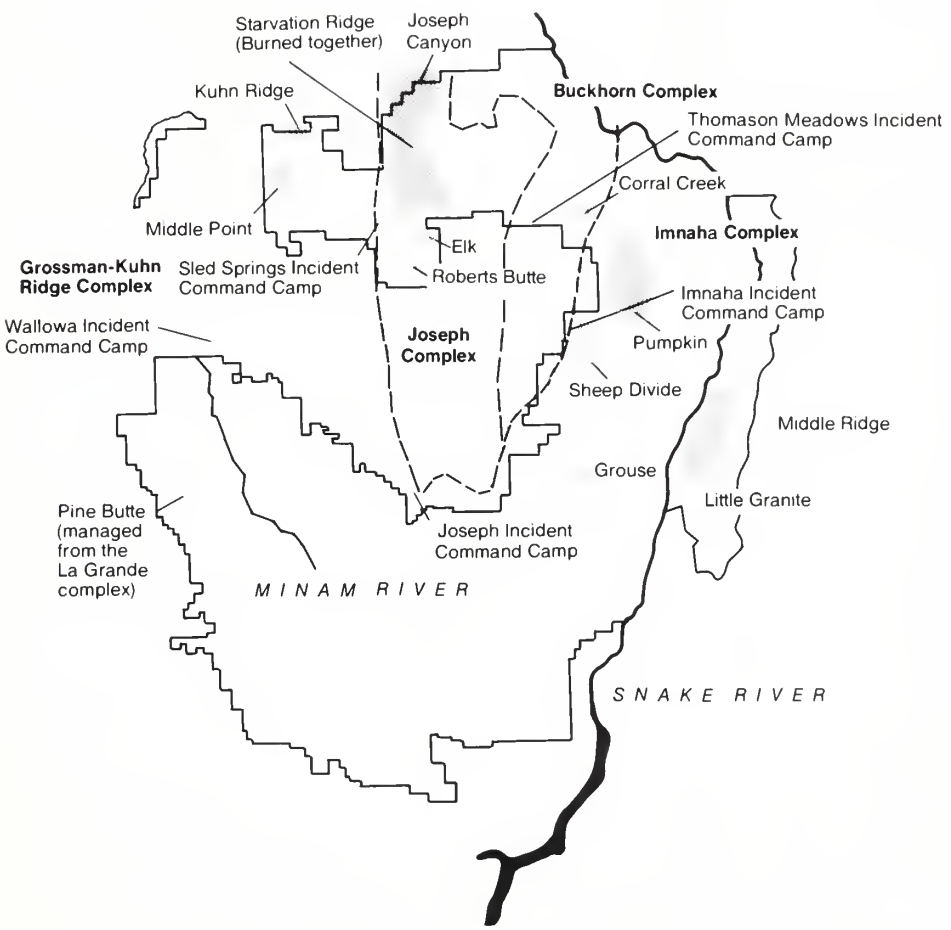
Imnaha River, which flows into the Snake River on the Oregon side of Hells Canyon. Near the site of the Pumpkin and Sheep Divide fires, August 1986.

Baker Unified Area Command (South Half)
August 3-18, 1986



These two maps show only the major fires that burned in the Baker and Wallowa Unified Areas during August 1986.

Wallowa Unified Area Command (North Half)
August 10-23, 1986



tation measures. Forage opportunities on most parts of the Forest will be enhanced because of fires in grassland communities. Visual qualities have been affected in many areas. A significant number of prehistoric and historic sites were destroyed or damaged.

Overall, fires on the Wallowa Unified Area Command followed the historic 60- to 100-year fire patterns, whereas fires on the Baker Unified Area Command generally burned hotter and in more continuously heavy fuels compared to previous large fires representing that area's pattern of a large fire every 60 years. Estimated available commercial forest acreage that was burned amounted to about 13,000 acres in the Wallowa Unified Area Command. Available commercial forest that was burned on the Baker Unified Area Command amounted to an estimated 19,850 acres.

Since the highest priority in all fire complexes was the protection of life and property, the existence of structures within and near the Forest boundaries presented the greatest challenge and caused the greatest expenditure of fire suppression resources. An example of this situation is the Frizzell Fire on Mt. Emily, which was only 670 acres but required a significantly large number of suppression forces because of its proximity to ranch homes and outbuildings.

Where Did They All Come From?

Many of the 338 fire crews and overhead came from home units throughout the Nation. State fire protection agencies from Oregon, Washington, California, Nevada, Minnesota, Wisconsin, South Dakota, South Carolina, and Texas sent fire crews or overhead. All Regions of the Forest Service were represented, with crews from 106 National Forests.

(Toward the third week in August, some crews had been fighting fire for nearly 3 weeks, so relief crews were sent into many of the mop-up operations. One bus unloaded an eager crew from the South along a fire-blackened, grim, still-smoldering mountainside near Anthony Lakes, in the rugged Elkhorn Mountain Range. Exhausted crews looked at one another in amazement when they heard the enthusiastic newcomers say, "Y'all have the nicest country we ever did see!" These new crew members from the southern States were good sports about the daily extremes in temperature in the Elkhorn and Wallowa Mountains—33 degrees at 4 a.m. and 93 degrees at 4 p.m. The commissaries ran out of long johns!)

Before the incident command teams were demobilized, personnel from the BLM, National Park Service, Oregon Air and Army National Guards, the Bureau of Indian Affairs, U.S. Air Force, National Weather Service, Fish and Wildlife Service and Federal Aviation Administration had been involved. The assistance of local agencies—rural fire departments, sheriff's departments, Oregon State Police, local police, and school districts—was outstanding. The cooperation of local city/county officials and the valiant efforts of local businesses contributed in large measure to the successful suppression efforts.

"It Seemed Like the Whole World Was Calling Up . . . "

Hardly a single resident of Baker, Union, and Wallowa counties in northeast Oregon was unaffected by the fire activity. They owned businesses that provided supplies and services; they (and often their equipment) were hired to work in fire camps or in fire suppression; they had operating mines, ranches, or logging operations near the fires; they were recreationists, or they simply were interested. It is "their" Forest and "their" BLM land—and it often seemed as if they were all calling on the phone simultaneously.

From throughout the Nation came thousands of phone calls from individuals, from television and radio networks, from newspapers and magazines, from State and Federal officials and politicians, from the families of firefighters. The number and diversity of inquiries were massive; these counties became the Nation's hotspot for news. These calls were handled day and night by the Forest's switchboard operators, receptionists, and interagency incident information officers. Information centers were set up in towns and in fire camps, and sometimes at crossroads in sight of the fires.

In addition, IIO's hosted dozens of walk-in "customers"—volunteers, county and State officials, off-duty overhead wanting to know "what was going on." Each day they

transported information bulletins and maps to over a dozen fire camps, and escorted dozens of TV and radio crews to camps and to the fireline. But with all the hectic activity of the information centers, their primary responsibility was to calm apprehensive local people who needed immediate information. Town meetings were organized; news briefs were distributed throughout towns and in remote rural locations; individuals were contacted—often with lengthy "one-on-one" reassurances. Uniformed IIO's were posted along major highways where the fires were visible. Dozens of bulletin boards were erected and updated several times daily.

The small towns and cities of eastern Oregon have cable television, but no live TV stations. The local cable stations each have an "information" channel, utilized by IIO's for quick dissemination of information, as were thrice-daily fire update tapes on local radio stations. Local news media people and local residents were given priority treatment by the IIO's, "even if NBC News was waiting in the wings," as one IIO stated.

The fire situation provided the opportunity for trained IIO's to disseminate information not only about the active fire situations, but about "light-hand-on-the-land" fire suppression; about the differences in "appropriate suppression tactics" (contain, confine, control); about interagency cooperation and the Incident Command System; about how past fire suppression philosophies have contributed to overcrowded, insect-infested timber stands.

Perhaps the greatest gratification to information people is the realization that, nationwide, the people of this country have a sense of concern, pride, and "ownership" in their National Forests—and they don't hesitate to let us know! ■

Horizontal Vortices and the New Miner Fire

Donald A. Haines

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The New Miner Fire

If you were not a member of a fire suppression crew, the afternoon of Mother's Day, May 9, 1976, was a beautiful time to be in central Wisconsin. Skies were mostly clear with the temperature in the high 70's, relative humidity near 20 percent, and winds, light and variable—just the kind of situation that can lead to explosive wildland fires in jack pine country at that time of year.

Fire towers reported smoke at 1415. At 1430, when the first forces arrived at the New Miner Fire, they found 2 acres of pine logging slash already burning with spot fires several hundred yards to the northeast. A tractor-plow unit was able to complete a circuit around the head of the fire, but the flames jumped the furrow almost immediately.

Within a few minutes the fire entered a pine plantation and began to crown. The fire grew in momentum as a light southwesterly wind pushed it through dense pine plantations and natural jack pine stands. Fire behavior became the major problem. The pine stands began to burn so intensely that flames reached 300 feet; at one point, suppression forces were concerned that spotting would carry embers across a 2.5-mile drainage area and begin a new series of fires on the other side.

Other interesting behavioral features quickly developed. As Bill Peterson, Wisconsin DNR (ret.), put it, "It appeared that the fire bucket was so full that flames began to spill over the sides." The smoke column split into two separate, slowly revolving vortices (fig. 1). Periodically these vortices spilled over the flanks, dropped to the ground (fig. 2), then reformed into a single column. Horizontal vortex activity along the flanks (fig. 3) threw so many firebrands into unburned fuels that, in some sectors, several lines were plowed parallel to and 200 feet out from the (initial) main body before suppression forces contained the lateral spread. A tractor operator plowing along the flanks about 20 feet from the main body of fire was trapped as flames from a horizontal vortex came over the top of his unit. His planned escape route was perpendicular to the flank of the main body of the fire, but this would have taken him into a region of intense fire activity. He escaped, but his tractor unit was destroyed.

Obviously this type of fire activity threatened suppression forces. What was happening? The horizontal vortices that formed in this fire were like slowly rolling cylinders of fire and ash, akin to lazy tornadoes lying on their sides. This type of vortex is a common feature of fluids. However, unlike vertical vortices, such as tornadoes or most fire whirls where the spin is rapid, the angular velocity of this type is usually quite low. These vortices, which may spiral out to the sides while moving downwind, are related to other phenomena: the slow swirls of air in the atmosphere that cause long parallel lines of clouds called "cloud streets" as well as the helical

Figure 1—*The smoke column on the New Miner Fire after splitting into a horizontal vortex pair. The ambient wind is blowing toward a point to the left of the observer.* (Photograph by Bill Peterson, Wisconsin Department of Natural Resources.)

Figure 2—*The split smoke column with the counterrotating vortex on the left side of the picture "collapsing and spilling" over the flank of the fire. The ambient wind is blowing toward a point to the left of the observer.* (Photograph by Bill Peterson.)

showing that a pair of horizontal vortices had formed, topping the smoke plume (fig. 4). The wind tunnel vortices are so similar to those seen in wildland fires that we believe that the laboratory simulation is close to the real thing.

We still don't understand several facts about these vortices. For example, they form under relatively low windspeeds, therefore, what are the upper limits of windspeed and turbulence intensity that will still allow formation? What is the cause of vortex collapse? We have generated a somewhat similar vortex collapse in a wind tunnel experiment using upstream obstacles that produced a wake effect, but we don't know if this is the same cause and effect relationship seen in nature.

motions in lakes that cause the formation of parallel lines of surface debris.

Wind Tunnel Simulation

We carried out a series of experiments, attempting to create horizontal vortices in a wind tunnel by first placing an electronically heated metal ribbon along the length of the tunnel floor. The heated ribbon simulated the flank of a wildland fire. Smoke generated upstream of the simulated fire flank made the air flow visible. As expected, buoyant forces caused by the heated ribbon created an upflow of air passing along and above the ribbon. A vertical slit cut into the wind tunnel's side allowed light into the tennel. The light outlined a thin crosssection of the smoke-filled air flow

Figure 3—*A vortex with a diameter of about 15 feet on the flank of the fire. Implied airflow is outlined by the curving arrows. Flames are moving out of the main body of fire at 30 to 50° angles and making "rolls" back into the fire. The ambient wind is blowing from right to left in the photograph.* (Photograph by Donald Krohn, Nekoosa Paper Inc., Port Edwards, WI.)

Figure 4—*A laser-illuminated, thin cross section of a vortex pair generated in a wind tunnel over a heated, longitudinally embedded nichrome wire simulating a fire's flank. The photograph was taken with the camera positioned downstream at the tunnel exit directly on the axis of flow.*

Have You Seen Them?

We would appreciate information from firefighters telling of their experiences with horizontal vortices so that we can compare our wind tunnel results to the wildland situation. Film, pictures, personal anecdotes, and action evidence of horizontal vortices will be gratefully received and acknowledged. Field feedback is essential to our understanding of this process; and understanding the characteristics of these vortices is important in fire behavior, in fire control, and in firefighter safety. ■

Direct Transfers of Federal Property

Several years ago the USDA Forest Service signed an agreement with the United States Department of the Interior, Bureau of Land Management (BLM) to facilitate the direct transfer of excess property between these agencies. One of the benefits of this agreement is that the Forest Service can lend property obtained from Federal excess to State forestry agencies for fire protection. Ironically, property disposed of by a BLM office can be transferred to the Forest Service and loaned to a State cooperator that assists in fire protection of the same BLM office. However, the State Forester will make the decision on where Federal excess property is assigned.

A new cooperative agreement between the Forest Service and the Department of the Interior (USDI) will soon be signed for the direct transfer of property. This agreement will authorize transfers between the USDA Forest Service and other land management agencies of USDI, namely, the National Park Service, the Bureau of Indian Affairs, the Fish and Wildlife Service, and the Bureau of Reclamation. ■

Rotary Wings of Fire

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The technology of rotary wing aircraft came into being after World War I, and the first recorded use of an "autogiro" in a fire-related situation occurred when the supervisor of the Los Padres National Forest, CA, used an autogiro for reconnaissance in the summer of 1922 (Johnston 1977, Wilson 1980). The development of helicopter technology progressed relatively slowly as compared to fixed-wing technology. This occurred on the Sudbury District of the Ontario Department of Lands and Forests in Canada (Johnston 1977).

There is some evidence that a helicopter was used on the Red Rock Fire near Castaic, CA in 1945. Regarding an incident purported to have occurred in 1943 on the Canal Oak Fire along the Kern River, CA, the assistant regional forester of USDA Forest Service Region 5, CA, "Ham" Pyle, stated that Stan Stevenson and he used a helicopter on this fire, and Stan broke his leg jumping from the helicopter. It was used to backfire, and rotor wash scattered the fire badly. It has been stated that helicopters were used quite generally in California on all major fires beginning in 1943 (Wilson 1978).

In any event, the first officially recognized uses were on the Red Rock Fire in 1945, and the Sudbury Fire in Canada in 1946. The helicopter pilot in Canada was Larry Bell, who later became famous as the founder of Bell Aircraft, which became Bell Helicopter Co. While there may have been experimentation with other uses on fires, at first the major use was for reconnaissance. The first record of extended uses of a helicopter on a fire was on the Bryant Fire on the Angeles National Forest, CA, in August of 1947. It was a Bell 47-B3 Model, and was used to move troops around the line, and for cargo, evacuations, hoverjumps, and reconnaissance. There was significant use during 1948 and 1949; in fact, a helicopter has been on contract on the Angeles National Forest since 1949. Mike Hardy in 1948 or 1949 experimented with dropping smokejumpers in the Bob Marshall Wilderness in Montana, and concluded that the program was not sound (Larkin 1986, Murphy 1986). Carl Wilson, Harry Grace, and Dick Johnson produced the first film on the "Use of Helicopters on Forest Fires" in 1950 without official sanction when Carl was assistant fire control officer (FCO) on the Angeles National Forest (Wilson 1986).

Bell helicopter laying hose.

A most significant research program began in late 1953 and 1954 under the conceptual leadership of Dr. Keith Arnold at the Pacific Southwest Forest and Range Experiment Station, USDA Forest Service. Project FIRESTOP, as it was known, began experimenting with the use of helicopters in the laying of hose, water delivery, pumping equipment, and hover-jumping. Both small and large helicopters were tried (Murphy 1986). One evening as Dr. Arnold and Carl Wilson were crossing the Oakland-San Francisco Bay Bridge they coined the word "HELI-TACK," and this became the name of the major effort that took off in 1954 as the National Interagency Helitack Project. Carl Wilson was the director of the project, which included both a research and development and an operational wing. Carl left the Angeles National Forest, as did Jim Murphy, Forest Air Officer, to become the nucleus of Project Helitack. Ralph Johnston took over as the National Forest Helitack Crew leader (Murphy 1986). Operationally the use of more helicopters, and a wider variety of uses took place in the 1950's. For example, there were 11 helicopters used on the Indian Valley Fire on the Los Padres (Johnston 1977).

The late 1950's and early 1960's were an exciting time in the development of uses of helicopters and in the equipment development phases. Herb Shields at the Arcadia Equipment Development Center, CA was working with hose-laying equipment, steps to support helijumping, tanks, and other water delivering systems, such as a long 35-gallon neoprene bag known as the elephant snout, the helipump, and gating systems for helicopters. Jay Peterson, Carl Wilson, Jim Murphy, Ralph Johnston, and others developed the air attack organization and the techniques and tactics for the use of helicopters on fires. In 1957 Ralph Johnston picked up on the "hoverdrop" idea and began work with the concept of dropping fire fighters from helicopters hovering as high as 20 feet above the ground. Jim Murphy concurrently worked with the UCLA Collision Injury Research Group to devise the technical standards (Murphy 1986, Wilson 1978). As many as 300 people were trained all over the West, but this technique never became a major use. This was called the "Helijump Program." From 1956 until 1961, Murphy, Johnston, and others worked toward a helitack guide to be used in training and for operations, but it remained until 1964 for Ralph Johnston, then at the Riverside Fire Laboratory, CA to publish the first one. Two significant events occurred in 1959: (1) Ralph Johnston ushered in the first operational (fire) medium helicopter, a Sikorsky S-55, at Chileao, and (2) the Los Angeles County Fire Department acquired a Bell G-2 helicopter, and trained its first helitack crew. Roland Barton, who had flown for the Los Angeles sheriff, became the first pilot for the Los Angeles County Fire Department.

The rapid increase in the use of helicopters led the Forest Service to concerns about the safety of the program since all of the equipment was coming from the private sector or from war surplus acquisitions. In 1958 an inspection program was begun: Karl Bryning was sent to the U.S. Army Helicopter School in Camp Walters, TX, and graduated in 1959; in 1960 Jim Larkin, Joe Jensen, and Bob McGregor were also trained, and these men became the helicopter inspectors thru the 1960's (Larkin 1986).

The first tests of nocturnal use of helicopters were conducted between 1965 and 1967 in California using hardware spin-offs from the Vietnam War. It was determined to be feasible, but not "administratively applicable" at this time (Wilson 1978). A fresh start began in 1973 using a larger helicopter, a Bell 204B, to evaluate the ability to see enough to fight fires at night. By September of 1974 pilots had tried the night vision goggles and forward-looking-infrared (FLIR) equipment and had made over 50 water drops (Wilson 1980). Jim Sanchez and Ted Hellmers, Los Angeles County Fire Department Pilots, were the first pilots to operate on a fire in 1975 using the night vision goggles (Sanchez 1986).

With the more ready availability of post-Vietnam War helicopters from the war surplus programs and the emergence of the turbine engines, larger, faster, and more versatile equipment came on the scene. The military Bell 204's and 205's, Bell Jet Rangers, Hughes 500's, and others provided more load capacity, speed, and range. The twin-engine machines, the 212,

and BO 105's added additional capability. Until the early 1970's the helicopters could carry only two or three people. The "medium" helicopter could carry from 10 to 14 personnel, so the strike forces of fire fighters became larger and more effective. A competition between smokejumpers and helitack crews was short lived, and a compromise 60-mile radius became an effective line between the optimum capabilities of the two technologies. Alaska began to use helicopters in the mid-60's when Bob McClellan of Boise, ID purchased an H-1100, four- or five-place helicopter and demonstrated its usefulness. The technology and techniques that were so successfully developed and tested in California had spread widely over the whole country. A driving force in this expansion was Ralph Johnston, who did more to formalize, systematize, and train personnel to make the helicopter an effective and safe as possible tool to use in fire programs. He left the USDA Forest Service in 1975 and joined the new Department of the Interior Office of Aircraft Services where he continued his active efforts in training until he retired in 1981.

The 1970's saw a continued expansion of the use of helicopters. Many of the techniques were refined, and some of the early equipment was modified and perfected. The tank developed for external mounting on the Los Angeles County Fleet of Bell 205's was improved by Lee Young and Dusty Gifford at BIFC; and Los Angeles County personnel; Bob Dupstadt of Bell Helicopters; and Bill Mansing of Sheet Craft of Palo Alto, CA. Tanks were developed and tailored to Bell Jet Rangers, Bell 206's, Bell 212's and 214's, and Hughes 500's. Much work was done toward developing a heli-tanker, and Boise Interagency Fire Center (BIFC), working with the above people, had developed an internal mounted tank that had a retardant capacity of up to 760 gallons on a Bell 214 (Young 1986). Work began on a Helicopter-Modular Airborne Fire Fighting System (H-MAFFS) unit but was never completed.

Unfortunately, the use of these machines, all from the private sector, became very costly. The cost for an hour of Jet Ranger time moved from $150 in the 1960's to $600 in the 1970's and early 1980's; and for a Bell 214 up to $3600. The economy wave of the late 1970's caused nearly all of the "medium" helicopters to be dropped out of the suppression system. In 1985 only three remained in the lower 48 States (all in California), plus three in Alaska with Federal agencies. Los Angeles County, however, developed its system around commercially certificated medium helicopters (a Bell 204 and three 205's), which they operate most effectively today. The State of California also elected to develop its own fleet of medium helicopters and bailed nine Bell UH-1F's, military on-line units, which they continue to operate very successfully. Some of the pioneers and conceptual thinkers of this era were Larry Pettibone and Clark Stuart at BIFC; Lynn Biddison, Carl Hickerson, Cal Ferris, and Karl Bryning of the USDA Forest Service; Roland Barton and Jim Sanchez of the Los Angeles County Fire Department; and Cotton Mason of the California Department of Forestry. Almost every kind of available helicopter has been tried in many ways to find new and better uses, including the S-62, the Flying Crane, and the Chinooks, but the sheer costs prohibit their use in our current fiscal climate. ■

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